Computer Science Program – Engineering

For students who matriculate into CoE Fall 2012 or later.
Fall 2012 – Winter 2023 Guide

Welcome!

Thank you for your interest in the EECS Department's Computer Science program in the College of Engineering. The fast rate of innovation in computer technology has created many new, exciting opportunities for students with Computer Science undergraduate degrees. Employment opportunities include: software development, game design, medicine, computer graphics, security, business management, consulting, computer systems analysis, data communications administration, robotics, artificial intelligence, knowledge engineering, hardware development, and many others. In addition, an undergraduate degree in Computer Science provides opportunities for masters, doctoral, and professional studies in various fields.

Computer science is an exceptional field. Computers have been around for only 70 years while most other scientific disciplines have been around for centuries. Progress in computer science has been extraordinarily rapid during this period, and computers have had a profound impact on society (can you envision life without text messaging, social networking, and Wifi?). Computer science research has provided much of the intellectual foundation and creative energy that fueled that transformation, and it continues to be an extremely exciting field.

Computer Science—College of Engineering (CS-Eng) Declaration Requirements

To declare a major in CS-Eng, you must be a College of Engineering student and:

1. Have completed at least one full term or 12 total credits at UM Ann Arbor
2. Have an overall UM GPA of 2.0 or better in courses taken at the UM Ann Arbor campus and be in good standing
3. Have completed or earned credit by exam or transfer for at least one course in each of these categories all with a grade of C or better (no Optional P/F):
    a. Calculus (e.g. Math 115, 116 or 156)
    b. Calculus-based physics lectures (e.g. Physics 140 or 160) or chemistry lectures (e.g. Chem 130)
    c. Required engineering courses (Engr 100, 101, or 151)

If you are interested in declaring a CS-Eng major and do not meet these requirements, please schedule an appointment with the CS-Eng Chief Program Advisor (CPA) to discuss your situation.

Getting Advice and Information

If you are a CS-Eng Major or considering becoming one, **you should meet with a CS-Eng Advisor** every semester, even if you know what courses you want to take. There may be options or constraints of which you are unaware. Frequent meetings with an advisor will help ensure that you get the most out of your education here and that there are no surprises when you apply for your diploma. You can schedule an advising appointment online.

Check the CSE Advising site for information about registration procedures, course offerings, book lists, time schedules, advising hours, and career information. You may contact the CS Undergraduate Advising Office (2808 BBB) at **ugadmin@eecs.umich.edu** or (734) 763-6563.

This document covers rules and advice for the CS-Eng program for Fall 2012 – Summer 2022. Your program is determined by the rules that were in effect when you entered the College of Engineering. If you entered the College of Engineering before Fall 2012, you are covered by a different set of rules.

CS-Eng & CoE Program Requirements and Grade Policies

College of Engineering Core Requirements

1. Engineering 100, and [Engineering 101 or Engineering 151 or EECS 180 AP credit or Robotics 102]
2. [Chemistry 125, Chemistry 126, and Chemistry 130] or [Chemistry 210 and Chemistry 211]
3. Physics 140, Physics 141, Physics 240, and Physics 241
4. Math:
    a. Math 115 or Math 120 (AP)
    b. Math 116 or Math 121 (AP)
    c. Math 214 (can also be satisfied with Math 217, Math 417, Math 419, or Robotics 101)
    d. Math 215 or Math 216 (If both Math 215 and Math 216 are taken, Math 216 can count as a Flexible Technical Elective.)
5. Intellectual Breadth: rules for this College requirement can be found in the CoE Bulletin under the "Intellectual Breadth" heading.
6. General Electives: 15 credits are "required"; CoE degrees require 128 total credits, and more or fewer GE credits may be needed to achieve this total depending on individual factors in a student's record.

Computer Science in Engineering Program Requirements

1. **Program Core:** All of the following courses are required:
    1. Computer Science: EECS 203 (or MATH 465/565*), EECS 280, EECS 281, EECS 370, EECS 376, and EECS 496 (or equivalent, see in Sample Schedule below)
        i. **Note that MATH 465/565 requires significantly more mathematical background than does EECS 203. Speak to an advisor before selecting these courses.*
    2. Probability and Statistics: STATS 250 or STATS 206/DATASCI 101 or STATS 280 or STATS 412 or STATS 426 or or EECS 301 or EECS 401 or IOE 265 or TO 301. (IOE 265 is generally open only to undeclared or IOE students. Students with credit from Statistics AP exams should pursue STATS 280 for this requirement. *Dual major/dual degree students, see the "Double major information" for possible substitutions.)*
    3. Technical Communications: TCHNCLCM 300 (for students taking ROB 204 as a Flexible Technical Elective, the TCHNCLCM 300 requirement will be waived)
2. **Technical Electives:** A minimum of 26 additional credits of technical electives is required:
    1. At least 16 of these credits must be in approved *Upper Level CS Technical Electives* (a list of approved courses is located on page 5).
    2. The remainder of the technical elective credits may be chosen from the approved *Flexible Technical Electives* lists (the CS-specific list is located on page 5; Flex Techs in other fields are listed online where there are courses in engineering, mathematics, or science that are approved as appropriate for CS students).
3. **Major Design Experience (MDE):** The MDE is a capstone design project that is recommended to be taken during one of your final two semesters. The technical writing requirement (2., below) must be taken in the same or later semester as the MDE (preferably the same semester).
    1. Please see details on how to complete MDE on an MDP project here: https://mdp.engin.umich.edu/cs/
    2. Technical writing and oral presentation: TCHNCLCM 497.

Major Grading & Repeat Policies

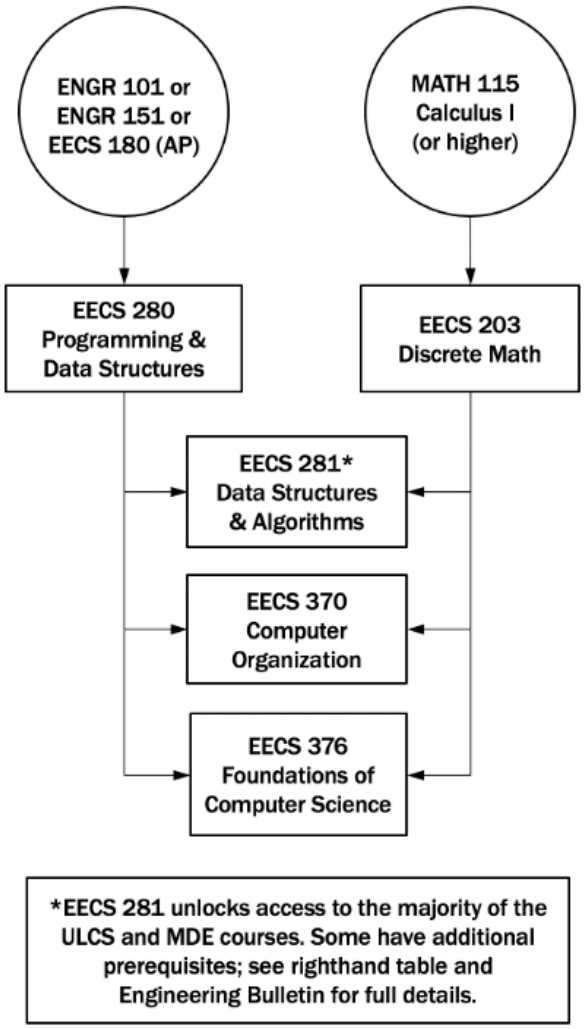
Grades of "C" or better must be achieved in all courses used to satisfy the pre-declaration and other major requirements. A grade of "C-" or below is considered a failing grade and the course must be repeated or substituted with another class.

Students are limited to attempting each of the three 200-level courses (EECS 203, EECS 280, EECS 281) at most twice. An attempt includes, but is not limited to, a notation of any letter grade (“A-F”), withdraw (“W”), Pass/Fail (“P”/” F”), Transfer ("T"), or Incomplete (“I”) posted on your U-M transcript. Any attempts from WN20 through SS21 terms are not counted in this limit. If you are seeking a third (or higher) attempt in EECS 203, EECS 280, or EECS 281, please submit a petition and include the following information: why your prior attempts were unsuccessful, and concrete steps you will take and changes you will make to succeed in your potential next attempt at the course. **Please note:** an advising appointment to discuss your plan is required in addition to submitting a petition.

If you currently have an Incomplete grade, you may proceed with the EECS coursework via override. Please submit an override request to enroll in courses that your Incomplete grade serves as a prerequisite to. If this Incomplete is in a pre-declaration requirement, you can proceed with declaring CS-Eng as your major once all other pre-declaration requirements are met. However, if you receive a final grade below a C after a letter grade is added, you are required to retake the course for a C or higher letter grade. This retake must be completed as soon as possible, and can be taken alongside other EECS courses, even if your failed class typically serves as a prerequisite. If an override is needed, please submit one here and attach any communication about your Honor Code decision in the form.

For questions about an incomplete related to an Honor Code case, please contact honorcouncil-admin@umich.edu.

Prerequisites and College Policies



	Prerequisites				
	EECS 281	EECS 370	EECS 376	Linear Algebra	Additional requirements
EECS 367	●			●	
EECS 373		●			EECS 270
EECS 388	●	Advisory			
EECS 390	●				
EECS 427					EECS 270, 312
EECS 440	●				
EECS 441	●	●			See CoE Bulletin
EECS 442	●			●	
EECS 445	●			●	
EECS 448	●			●	
EECS 449	●				
EECS 467	●			●	EECS 367
EECS 470		●			EECS 270
EECS 471	●	●			
EECS 473	●				EECS 373
EECS 475			●		
EECS 476	●			●	
EECS 477	●		●		
EECS 478					EECS 203, 270
EECS 480	●				EECS 485 or 493
EECS 481	●				
EECS 482	●	●			
EECS 483	●	●			
EECS 484	●				
EECS 485	●				
EECS 486	●				
EECS 487	●				
EECS 489	●	●			
EECS 490	●				
EECS 491	●	●			EECS 482
EECS 492	●				
EECS 493	●				
EECS 494	●				
EECS 495	●				
EECS 497	●	●			See CoE Bulletin

College of Engineering Policies

Intellectual Breadth: Intellectual Breadth requirements are complex and not always intuitive. For details, see the CoE Bulletin under the "Intellectual Breadth" heading at https://bulletin.engin.umich.edu/ug-ed/reqs/. Further questions about this requirement can be directed to the EECS Undergraduate Advising Office. [Note that **Test Credit for Foreign Languages** (AP credits and credits by exam) at the 100-level count only as general electives.]

Dual majors: To earn dual majors within Engineering, you must satisfy the requirements for both programs and take at least 14 additional credit hours of pertinent technical electives beyond either major (142 credits total). You should schedule advising appointments **at both departments** to determine allowable overlap among requirements.

Pass/Fail is only allowed for Intellectual Breadth requirements and general electives. You may take at most 2 courses pass/fail per term (1 during Spring or Summer half-terms) and at most 14 credits total. This can be a good way to maintain a good GPA while exploring different types of courses within the University.

Transfer credit: UM maintains a list of approved transfer courses from other U.S. institutions at https://transfercredit.ugadmiss.umich.edu/. Transfer courses from international institutions can be found at https://apps.engin.umich.edu/equivalencies/ for CoE and https://www.ugadmiss.umich.edu/TCE/Public/CT_TCESearch.aspx for non-CoE courses. Courses that do not appear on one of these lists may still transfer but will need to be reviewed. *Keep in mind that you must take 50 credits hours on the Ann Arbor campus.*

This includes the Computer Science Residency requirement, which requires 30 credit hours of 300 or higher technical courses taken at UM-AA while enrolled in CoE. These 30 credits come from UM-AA courses at the 300+ level satisfying Program Subjects (EECS 370, EECS 376, EECS 496, TCHNCLCM 300, TCHNCLCM 497, 300+ STATS), Technical Electives (ULCS and FTE), and Major Design Experience.

CS-Eng Sample Schedule

Below is an eight-semester (four-year) plan to help students envision how requirements may fit together over the course of their time at Michigan. This plan is only a sample; it is not necessary to follow the below plan exactly outside of following prerequisite chains.

Course Planning: Students can reference the EECS course descriptions and Atlas for a basic introduction to our courses. CSE Peer Advisors have also developed an ULCS/Senior Design Info Sheet providing student narratives about their experiences in our courses. Several core course syllabi are also available at the link provided. For more planning assistance, students should schedule an appointment with an advisor on the EECS undergraduate website

	Total Credits	Terms							
		1	2	3	4	5	6	7	8
Subjects Required by all Programs (55 hours)									
Mathematics 115, 116, and 214[1]	**12**	**4**	**4**		**4**				
Mathematics 215 or 216[2]	**4**					**4**			
Engineering 100, Introduction to Engineering	**4**		**4**						
Engineering 101, Introduction to Computers[6]	**4**	**4**							
Chemistry [125/126 and 130] or Chemistry [210 and 211]	**5**	**5**							
Physics 140 and Lab 141	**5**		**5**						
Physics 240 and Lab 241	**5**			**5**					
Intellectual Breadth	**16**	**4**	**4**		**4**	**4**			
Program Subjects (26 hours)									
EECS 203, Discrete Mathematics (or MATH 465/565)	**4**			**4**					
EECS 280, Programming and Elementary Data Structures	**4**			**4**					
EECS 281, Data Structures and Algorithms	**4**				**4**				
EECS 370, Introduction to Computer Organization	**4**					**4**			
STATS 250 or STATS 206 or STATS 280 or STATS 412 or STATS 426 or EECS 301/401 or TO 301 or IOE 265	**3**						**3**		
EECS 376, Foundations of Computer Science	**4**						**4**		
TCHNCLCM 300	**1**						**1**		
EECS 496 (or ENGR 499-002, or COMPFOR 111 through WN25, or approved Special Topics sections)	**2**							**2**	
Major Design Experience (6 hours)									
Approved CS MDE course[3]	**4**							**4**	
TCHNCLCM 497	**2**							**2**	
Technical Electives (26 hours)									
Upper Level CS Technical Electives[4]	**16**						**4**	**4**	**8**
Flexible Technical Electives[5]	**10**				**4**	**4**			**2**
General Electives (15 hours)	**15**			**3**			**4**	**4**	**4**
Total	**128**	**17**	**17**	**16**	**16**	**16**	**16**	**16**	**14**

Notes:

Credits from a course may only be used to fulfill a single requirement (no double-counting).

1. The requirements for MATH 214 can alternatively be satisfied by MATH 217, 417, 419, or Robotics 101.
2. If both MATH 215 and MATH 216 are taken, MATH 216 can count as a Flexible Technical Elective.
3. See page 5 for the current list. TCHNCLCM 497 must be taken in the same or later semester as the MDE (preferably the same semester).
4. See page 5 for the current list.
5. A maximum of 4 credits of EECS 499/399 (or other upper-level directed/independent study) may count in Flexible Technical Electives; additional will count as general electives. Check with an advisor to ensure you are not in violation of this policy.
6. The requirement for ENGR 101 can also be satisfied by Engineering 151, EECS 180 AP credit, EECS 183, or Robotics 102

CS-Eng Technical Electives

Discuss your elective choices with an EECS faculty member in your area of interest, or with a CS advisor. Note: An EECS course may only count toward one requirement—either ULCS *or* MDE, not both.

Upper-Level CS (ULCS) Electives

You must take at least 16 credits of Upper-Level CS (ULCS) Electives from the list below. Any credits you earn in ULCS and MDE courses beyond the minimum 16 will count toward your Flexible Technical Electives requirement.

367	Introduction to Autonomous Robotics
373	Design of Microprocessor Based Systems
388	Introduction to Computer Security
390	Programming Paradigms
427	VLSI Design I
442	Computer Vision
445	Introduction to Machine Learning
470	Computer Architecture
471	Applied Parallel Programming with GPUs
475	Introduction to Cryptography
476	Data Mining
477	Introduction to Algorithms
478	Logic Circuit Synthesis and Optimization
481	Software Engineering (taken FA17 or after)
482	Introduction to Operating Systems
483	Compiler Construction
484	Database Management Systems
485	Web Database and Information Systems
486	Information Retrieval & Web Search
487	Introduction to Natural Language Processing
489	Computer Networks
490	Programming Languages
491	Introduction to Distributed Systems
492	Introduction to Artificial Intelligence
493	User Interface Development

Major Design Experiences (MDE)

440	System Design of a Search Engine
441	Mobile App Development for Entrepreneurs
448	Applied Machine Learning for Modeling Human Behavior
449	Conversational Artificial Intelligence
467	Autonomous Robotics
470	Computer Architecture
473	Advanced Embedded Systems
480	Social Computing Systems
494	Computer Game Design and Development
495	Software for Access
497	Human-Centered Software Design & Development

Flexible CS Technical Electives

The courses listed on this webpage have been approved as Flexible CS Technical Electives. This list includes courses at the graduate level (numbered 500 and above). Students with interests in research, graduate school, and/or specific areas should discuss this with the Chief Program Advisor, who may approve graduate courses on a per-student basis for use as ULCS (approval must be obtained before registering for one).

Note: EECS 398, 498, and 598 are Special Topics courses. Individual sections may carry approvals as MDE, ULCS elective credit, or CS Flexible Technical elective credit. Approved requirements for each section are listed online every term.

Elective Groups

The CS program has no official specializations, and we encourage students to take electives across a broad range of topics in computer science. However, if you want to specialize in a specific topic, consider these groupings:

- **Computer hardware**: 270, 373, 427, 470, 478
- **System software**: 482, 483, 484, 489, 491
- **Intelligent systems**: 442, 445, 467, 486, 492
- **Software development**: 482, 484, 485, 494
- **Theory of computation**: 475, 477, 490
- **Web technology & applications**: 285, 388, 485, 493, 486

General Advice and Departmental Opportunities

GENERAL ADVICE

- **Mental Health:** If you're feeling stressed, depressed, or just need someone to talk to, there are many places to find support on campus: https://care.engin.umich.edu/student-support-services/.
- **Information from Friends:** Your friends can be a good source of information on certain topics, like the workload in courses they have taken. However, they can be an unreliable source of information for details of program and college requirements. For specific questions about program requirements, always check with the advising office rather than relying on word-of-mouth.
- **Directed / Independent Study and Research:** Only 4 hours of directed/independent study or research courses (total across all depts., i.e. EECS, ENGR, IOE, Civil, etc.) can count toward Flexible Technical Electives. EECS 499 is only open to seniors; sophomores & juniors should consider EECS 399 (either can count as Flexible Technical Elective credit, up to 4 credits).
- **Course Sequencing and Workload:** Student feedback about workload in CS courses can be found online: http://cse.engin.umich.edu/academics/course-information/workload-surveys/. There is considerable variance for courses because different students find different aspects of courses challenging (writing complicated programs, understanding math concepts, etc.) Below is a summary synthesizing workload survey data with other relevant course information to estimate workload:
    - *Extremely heavy workload:* 467, 470, 473, 482, 494
    - *Heavy workload:* 281, 373, 445, 483, 489
    - *Moderate workload:* 203, 280, 285, 370, 376, 388, 442, 475, 477, 478, 481, 484, 485, 490, 492
    - *Light workload:* 183, 441, 486, 493, 496, 497
- CS courses can be more demanding relative to many courses at the University, so we advise students to avoid overloading themselves. For most CS students, a load of 2 CS courses in the same semester is normal, but that can vary based on the combination of CS courses chosen (e.g., a CS course with an extremely heavy load should only be paired with one with a moderate load or less), as well as what non-CS courses are being taken at the same time. We encourage students to talk with CSE advisors if they have questions about the course load they are considering.
- **EECS 203 & EECS 280:** Taking EECS 203 (Discrete Structures) and EECS 280 (Programming) simultaneously often works well, and these are the prereqs for the "gateway" course, EECS 281 (Data Structures & Algorithms).
- **EECS 281:** Take EECS 281 as soon as you can. This is the "gateway" course to all Upper Level CS Courses.

- **EECS 270 & 370:** Many students say that EECS 270 (which counts as a CS Flexible Tech Elective) makes EECS 370 easier. Others say that the 203 prerequisite is good enough and don't want to use a flexible technical elective on 270. You will probably get more out of 370 by taking 270 first, but this is not required.
- **TCHNCLCM 300 is a prerequisite for TCHNCLCM 497**. The Technical Communications department manages all TCHNCLCM courses. Please visit https://techcom.engin.umich.edu/ for questions or issues with registration of these courses.

DEPARTMENTAL OPPORTUNITIES

- **Research:** A great deal of leading-edge academic research is carried out at UM. If you show that you can do the work, you can get involved in this research as an undergraduate, which will provide you with extraordinarily valuable training for future work in the field. For more details, see https://cse.engin.umich.edu/academics/undergraduate-research/.
- **Teaching—Become an Instructional Aid:** The discussion sections for EECS 183, EECS 280, EECS 281, and ENGR 100 (CSE-based topics) are led primarily by undergraduates. As a section leader, you will have the chance to teach the next generation of CSE majors and get them excited about computing. Look for IA hiring announcements via email each term.
- **Mentoring—Become a Peer Advisor:** Share your experiences with other undergraduates. If you are interested, check in with the CSE Undergraduate Advising Office for information. Opportunities are available at both the department and CoE levels.
- **Getting Involved—Join an EECS Student Group:** Enhance your undergraduate experience and resume by joining a student group: https://cse.engin.umich.edu/culture/student-groups-and-teams/.
- **Getting Experience—Internships, Co-ops, and Job Opportunities:** Many companies hire students for internships upon completion of EECS 281 (for some, even after EECS 280!). You can view current CS intern & job opportunities through the Engineering Career Resource Center (ECRC), https://career.engin.umich.edu/, or through the fall and winter **Career Fairs,** https://career.engin.umich.edu/events/career-fairs/.